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(54) **A WASHING MACHINE COMPRISING A WATER SOFTENING UNIT**

(57) The present invention relates to a washing machine (1) comprising a body (2); a washing chamber (3) which is disposed in the body (2) and wherein the washing process is performed; a water softening unit (4) which is suitable for receiving a water softening member which reduces the hardness of the water to be used in the washing process; a salt box (5) which is suitable for receiving the salt used for regenerating the water softening member; and a salt filling line (6) with one end opening into the salt box (5) and which enables the user to fill salt into the salt box (5).

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Description

[0001] The present invention relates to a washing machine which comprises a water softening unit.

[0002] In washing machines, water softening units are used for decreasing the hardness of the washing water and for providing an effective washing. The water softening unit comprises a water softening member which enables the hardness of the water to be removed. The hardness of the mains water passed through the water softening unit is reduced, which is then transferred to the tub to be used in the washing process. The ion retaining feature of the water softening member in the water softening unit decreases over time. The regeneration of the water softening member is performed by means of brine. Generally, in washing machines with a water softening unit, there is a salt box which is connected to the water softening unit by means of a regeneration line and which contains the salt used to regenerate the water softening member in the water softening unit by being soaked in brine. In the state of the art washing machines, it cannot be determined instantaneously whether salt is filled into the salt box. Therefore, while the user is filling salt into the salt box, the brine in the salt box overflows from the salt box and causes rust and corrosion on the sheet metal of the washing machine.

[0003] In the state of the art Patent Application Document No. WO2018103962 (A1), a washing machine comprising a water softening unit is disclosed.

[0004] The aim of the present invention is the realization of a washing machine wherein adding salt into the salt box can be effectively detected.

[0005] The washing machine of the present invention comprises a body; a washing chamber which is disposed in the body and wherein the washing process is performed; a water softening unit which is suitable for receiving a water softening member which reduces the hardness of the water to be used in the washing process; a salt box which is suitable for receiving the salt used for regenerating the water softening member; and a salt filling line with one end opening into the salt box and which enables the user to fill salt into the salt box. The water softening member can be a resin. The resin enables the magnesium and calcium ions in the water to be retained, thus reducing the hardness of the water. The ions in the water are collected on the resin. Upon reaching the total ion holding capacity thereof, the resin can be renewed so as to perform the water softening function again with the regeneration process performed. The brine is delivered into the water softening unit for the regeneration process. The regeneration of the resin is achieved by replacing the sodium ions in the brine solution with the calcium and magnesium ions remaining on the resin. The washing machine of the present invention further comprises a sensor which is positioned in the vicinity of the salt filling line, and a control unit which decides whether salt is added to the salt box according to the data received from the sensor. The control unit can determine whether the user has filled salt into the salt box before the washing process according to the data received from the sensor. The sensor may be positioned in the salt filling line. The sensor may be disposed on the side walls forming the salt filling line. The sensor may be positioned on the body wall whereon the end of the salt filling line which can be accessible by the user is arranged.

[0006] In an embodiment of the present invention, the sensor is disposed in the salt filling line. Said sensor may be a sensor which can detect the penetration of any object into the salt filling line. In a preferred embodiment of the present invention, a magnetic sensor is provided in the salt filling line. When a salt filling container suitable for placing salt is penetrated into the salt filling line, there is a magnetic member which is disposed at the part of the salt filling container penetrated into the salt filling line. As a result of the detection of said magnetic member by the magnetic sensor, the control unit can determine that salt is filled into the salt box.

[0007] In an embodiment of the present invention, the washing machine comprises a discharge line which is connected to the salt box and which enables the water in the salt box to be transferred to a discharge outlet opening to the outside environment. The control unit discharges the water in the salt box to the outside environment by controlling the valve on the discharge line. In a preferred embodiment of the present invention, the valve is a solenoid valve. When by means of the data received from the sensor, the control unit determines that salt has been added into the salt box, the control unit opens the valve and discharges the water in the salt box. Thus, the brine is prevented from overflowing from the salt box and flowing into the body. Consequently, rust and corrosion formation in the body is prevented.

[0008] In an embodiment of the present invention, the control unit stops the operation of the washing machine upon detecting that salt has been added into the salt box. By stopping the operation of the washing machine, the vibrations which occur during the operation of the washing machine are stopped. Thus, the brine in the salt box is prevented from overflowing from and spilling out of the salt box as a result of shaking. Consequently, damage to the components in the body is prevented. Moreover, by stopping the operation of the washing machine, the water intake into the washing chamber is stopped. Thus, the brine is prevented from being transferred to the washing chamber as a result of overflow in the salt box.

[0009] In an embodiment of the present invention, the washing machine comprises a salt filling line which opens into an inlet opening on the body and which extends between the inlet opening and the salt box so as to enable the salt to be filled into the salt box. By means of the salt filling line, the user is enabled to put salt into the salt box. In case the salt box is fixed in a compartment in the body which cannot be accessed by the user, it is not possible for the user to access the salt box from the outside. Thus, a salt filling line extending between the salt box and the body is formed such that the user is enabled to add salt

into the salt box.

[0010] In an embodiment of the present invention, the washing machine comprises a lid which covers the inlet opening. Thus, the salt box is leak-proofingly closed. Consequently, unwanted substances such as water, dirt and dust are prevented from entering the salt box through the salt filling line.

[0011] In an embodiment of the present invention, the sensor comprises a switch which is positioned in the vicinity of the salt filling line so as to contact the lid when the lid is in the closed position. In a preferred version of the present invention, the switch is disposed on the salt filling line. When the lid is in the closed position, the switch is pressed and the switch shifts to the closed position. When the switch is in the closed position, the control unit determines that no salt has been added into the salt box. When the lid is brought to the open position, the lid and the switch do not contact each other and the switch shifts to the open position. When the switch shifts to the open position, the control unit determines that salt has been added into the salt box.

[0012] In an embodiment of the present invention, the inlet opening is arranged on the front wall. The front wall is the surface of the body whereon an access opening which allows access into the washing chamber is arranged. Thus, the user's access to the inlet opening is facilitated.

[0013] The washing machine realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 - is the sideways perspective view of the body of the washing machine related to an embodiment of the present invention.

Figure 2 - is the front perspective view of the body of the washing machine related to an embodiment of the present invention.

Figure 3 - is the perspective view of the water softening unit, the salt box and the salt filling line of the washing machine related to an embodiment of the present invention.

Figure 4 - is the schematic view of the washing machine related to an embodiment of the present invention when the lid is in the open position.

Figure 5 - is the schematic view of the washing machine related to an embodiment of the present invention when the lid is in the closed position.

Figure 6 - is the schematic view of the washing machine related to an embodiment of the present invention.

[0014] The elements illustrated in the figures are numbered as follows:

1. Washing machine

2. Body
21. Front wall

3. Washing chamber

4. Water softening unit

5. Salt container

6. Salt filling line
61. Inlet opening

7. Sensor
71. Switch

8. Control unit

9. Discharge outlet

10. Discharge line

11. Valve

12. Lid

13. Detergent dispenser

A. Access opening

[0015] The washing machine (1) comprises a body (2); a washing chamber (3) which is disposed in the body (2) and wherein the washing process is performed; a water softening unit (4) which is suitable for receiving a water softening member which reduces the hardness of the water to be used in the washing process; a salt box (5) which is suitable for receiving the salt used for regenerating the water softening member; and a salt filling line (6) with one end opening into the salt box (5) and which enables the user to fill salt into the salt box (5). The washing water delivered to the washing chamber (3) is passed through the water softening unit (4) and transferred to the detergent dispenser (13). The washing water is then transferred from the detergent dispenser (13) to the washing chamber (3). Thus, the hardness level of the washing water to be sent into the washing chamber (3) is reduced. Consequently, the stain removal performance of the washing water is increased. Moreover, an energy-saving washing machine (1) is realized since the same stain removal performance can be achieved with less water and detergent usage. The ability of the water softening member disposed in the water softening unit (4) to reduce the hardness of the water passed thereover decreases over time. In this case, the water softening member is regenerated. In order to ensure the regeneration of the water softening member, a brine solution is obtained by sending water into the salt box (5). Said brine

solution is then transferred into the water softening unit (4) through a regeneration line. The brine solution provides that the ions on the water softening member pass into the brine, allowing the water softening member to gain the ability to reduce the water hardness again. As a result of this process, the amount of salt in the salt box (5) decreases. The user can add salt into the salt box (5) through the salt filling line (6) opening into the salt box (5).

[0016] The washing machine (1) of the present invention further comprises a sensor (7) which is positioned in the vicinity of the salt filling line (6), and a control unit (8) which decides whether salt is added to the salt box (5) according to the data received from the sensor (7). The control unit (8) can instantly determine that salt has been added into the salt box (5). Moreover, before the first washing cycle to be performed, the control unit (8) can instantly determine that salt has been added into the salt box (5). The sensor (7) can be positioned on the salt filling line (6). The sensor (7) can be disposed on the side walls surrounding the salt filling line (6). By means of the sensor (7), salt entry into the salt filling line (6) can be detected. According to the data received from the sensor (7), the control unit (8) can determine that salt has been filled into the salt box (8) instantly or before the next washing cycle through the salt filling line (6).

[0017] In an embodiment of the present invention, the washing machine (1) comprises the sensor (7) which is disposed in the salt filling line (6). Said sensor (7) can be a photoreceptor, an optical detection device or a sensor (7) containing a laser. When the salt enters the salt filling line (6), said salt can be detected by the sensor (7). Similarly, if a part of a container containing salt enters the salt filling line (6), said container can be detected by the sensor (7). When the sensor (7) detects an object entering the salt filling line (6), the control unit (8) determines that salt has been added into the salt box (5).

[0018] In an embodiment of the present invention, the washing machine (1) comprises a discharge line (10) which extends between the salt box (5) and a discharge outlet (9) opening to the outside environment; a valve (11) which is disposed on the discharge line (10); and the control unit (8) which enables the water in the salt box (5) to be discharged by opening the valve (11) when it is determined that salt has been added into the salt box (5). The discharge line (10) enables the water in the salt box (5) to be delivered to the discharge outlet (9) such that the water in the salt box (5) is discharged. The control unit (8) enables the water in the salt box (5) to be discharged by controlling the valve (11) disposed on the discharge line (10). The valve (11) disposed on the discharge line (10) has an open position wherein the valve (11) enables the water in the salt box (5) to be transferred to the discharge outlet (9) and a closed position wherein the valve (11) prevents the water in the salt box (5) from being delivered to the discharge outlet (9). Upon detecting that salt has been added into the salt box (5) by the user, the control unit (8) shifts the valve (11) to the open position so as to enable the water to be discharged from the salt box (5). Upon determining that salt has been added into the salt box (5) between the first washing cycle and the second washing cycle, which are two consecutive washing cycles, the control unit (8) enables the water in the salt box (5) to be discharged before starting the second washing cycle. Thus, the water in the salt box (5) is prevented from overflowing as a result of filling the salt box (5). Thus, damage to the components in the washing machine (1) is prevented. Moreover, the brine is prevented from overflowing through the salt filling line (6) and from flowing out of the body (2).

[0019] In an embodiment of the present invention, the washing machine (1) comprises the control unit (8) which stops the operation of the washing machine (1) when it is detected that salt has been added into the salt box (5). While the washing machine (1) is in operation, vibrations may occur in the body (2) when a drum disposed in the body (2) is rotated at high speeds by a motor. When the control unit (8) determines that salt has been added into the salt box (5), the operation of the washing machine (1) is stopped in order to prevent the overflow of the brine in the salt box (5) as a result of said vibrations. When the operation of the washing machine (1) is stopped, the electric motor and therefore the rotation of the drum are stopped so as to prevent vibrations.

[0020] In an embodiment of the present invention, the washing machine (1) comprises a salt filling line (6) which opens into an inlet opening (61) on the body (2) and which extends between the inlet opening (61) and the salt box (5) so as to enable the salt to be filled into the salt box (5). By means of the salt filling line (6), the user can put salt into the salt box (5). Thus, when the amount of salt in the salt box (5) decreases, the user is enabled to fill the salt box (5) with salt through the inlet opening (61) provided on the body (2).

[0021] In an embodiment of the present invention, the washing machine (1) comprises a lid (12) which has a closed position wherein the lid (12) closes the inlet opening (61) and an open position wherein the lid (12) opens the inlet opening (61) so as to provide access to the salt filling line (6). When the lid (12) is in the closed position, the salt filling line (6) is closed so as to prevent air entry. Thus, the salt in the salt box (5) is prevented from becoming stale. When the lid (12) is brought to the open position, the user can add salt into the salt box (5) through the salt filling line (6). The lid (12) can be moved between the closed position and the open position.

[0022] In an embodiment of the present invention, the washing machine (1) comprises the sensor (7) comprising a switch (71) which is positioned in the vicinity of the salt filling line (6) so as to contact the lid (12) when the lid (12) is in the closed position. The switch (71) contacts the lid (12) when the lid (12) is in the closed position. When the lid (12) is brought to the open position, the contact between the switch (71) and the lid (12) is cut off. The control unit (8) determines that the lid (12) is in the closed position when the switch (71) and the lid (12) contact each other. When there is no contact between

the lid (12) and the switch (71), the control unit (8) determines that the lid (12) is in the open position. Thus, it can be easily determined whether the lid (12) is in the open or closed position. Upon determining that the lid (12) is in the open position, the control unit (8) determines that salt has been added into the salt box (5). Upon determining that the lid (12) is in the open position at least once between the first washing cycle and the second washing cycle, which are two consecutive washing cycles, the control unit (8) determines that salt is added into the salt box (5) before the second washing cycle.

[0023] In an embodiment of the present invention, the washing machine (1) comprises the inlet opening (61) which is provided on a front wall (21) on the body (2) whereon an access opening (A) providing access to the washing chamber (3) is arranged. The front wall (21) forms the surface of the body (2) which is easiest to access by the user. Thus, it becomes easier for the user to add salt into the salt box (5).

[0024] By means of the present invention, a washing machine (1) is realized, wherein the process of adding salt into the salt box (5) is effectively determined by the data received from a sensor (7) positioned in the vicinity of the salt filling line (6).

Claims

1. A washing machine (1) **comprising** a body (2); a washing chamber (3) which is disposed in the body (2) and wherein the washing process is performed; a water softening unit (4) which is suitable for receiving a water softening member which reduces the hardness of the water to be used in the washing process; a salt box (5) which is suitable for receiving the salt used for regenerating the water softening member; and a salt filling line (6) with one end opening into the salt box (5) and which enables the user to fill salt into the salt box (5),

   - **characterized by** a sensor (7) which is positioned in the vicinity of the salt filling line (6), and a control unit (8) which decides whether salt is added to the salt box (5) according to the data received from the sensor (7).

2. A washing machine (1) as in Claim 1, **characterized by** the sensor (7) which is disposed in the salt filling line (6).

3. A washing machine (1) as in Claim 1 or 2, **characterized by** a discharge line (10) which extends between the salt box (5) and a discharge outlet (9) opening to the outside environment; a valve (11) which is disposed on the discharge line (10); and the control unit (8) which enables the water in the salt box (5) to be discharged by opening the valve (11) when it is determined that salt has been added into the salt box (5).

4. A washing machine (1) as in any one of the above claims, **characterized by** the control unit (8) which stops the operation of the washing machine (1) when it is detected that salt has been added into the salt box (5).

5. A washing machine (1) as in any one of the above claims, **characterized by** the salt filling line (6) which opens into an inlet opening (61) on the body (2) and which extends between the inlet opening (61) and the salt box (5) so as to enable the salt to be filled into the salt box (5).

6. A washing machine (1) as in Claim 5, **characterized by** a lid (12) which has a closed position wherein the lid (12) closes the inlet opening (61) and an open position wherein the lid (12) opens the inlet opening (61) so as to provide access to the salt filling line (6).

7. A washing machine (1) as in Claim 6, **characterized by** the sensor (7) comprising a switch (71) which is positioned in the vicinity of the salt filling line (6) so as to contact the lid (12) when the lid (12) is in the closed position.

8. A washing machine (1) as in any one of Claims 5 to 7, **characterized by** the inlet opening (61) which is provided on a front wall (21) on the body (2) whereon an access opening (A) providing access to the washing chamber (3) is arranged.

Figure 1

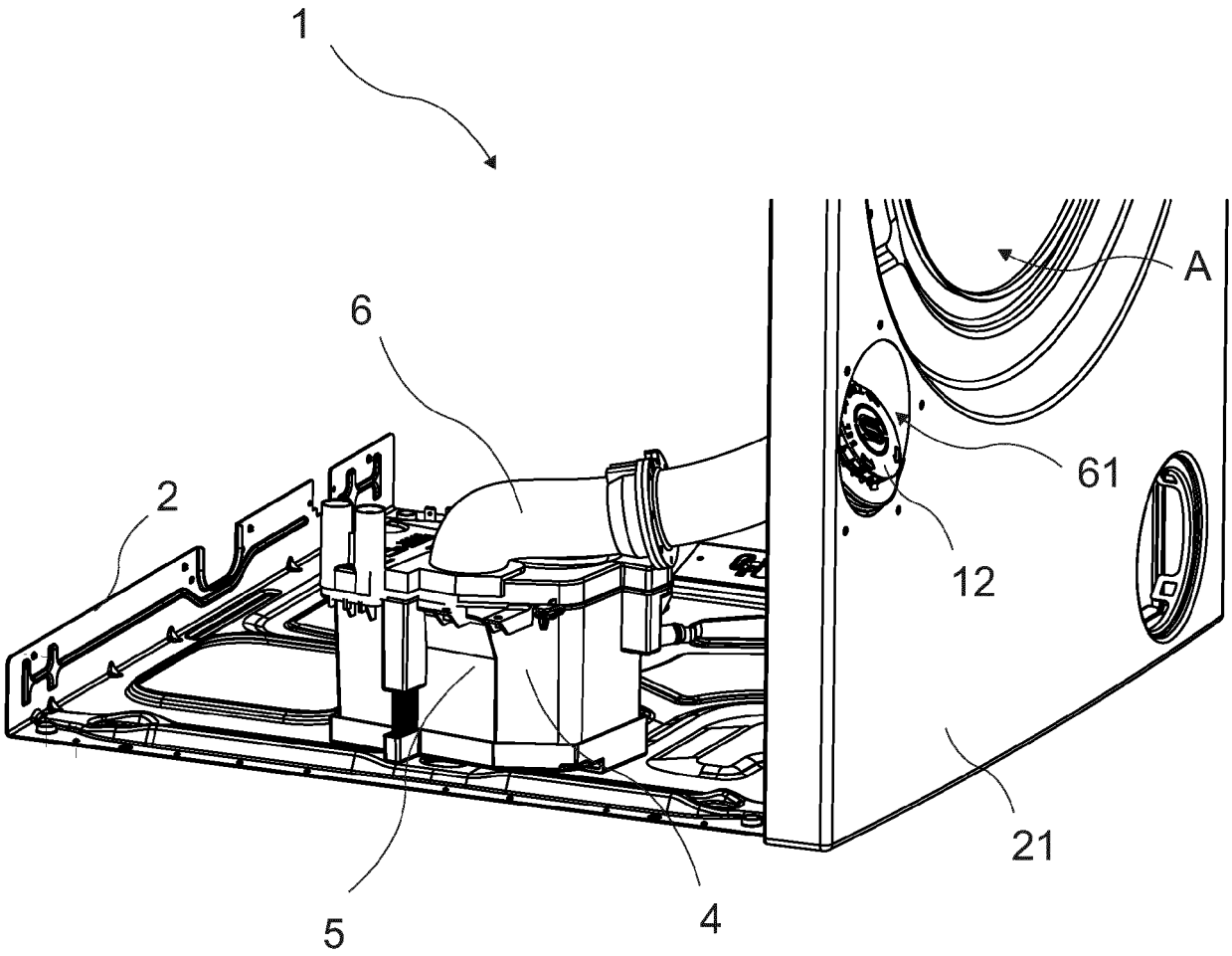


Figure 2

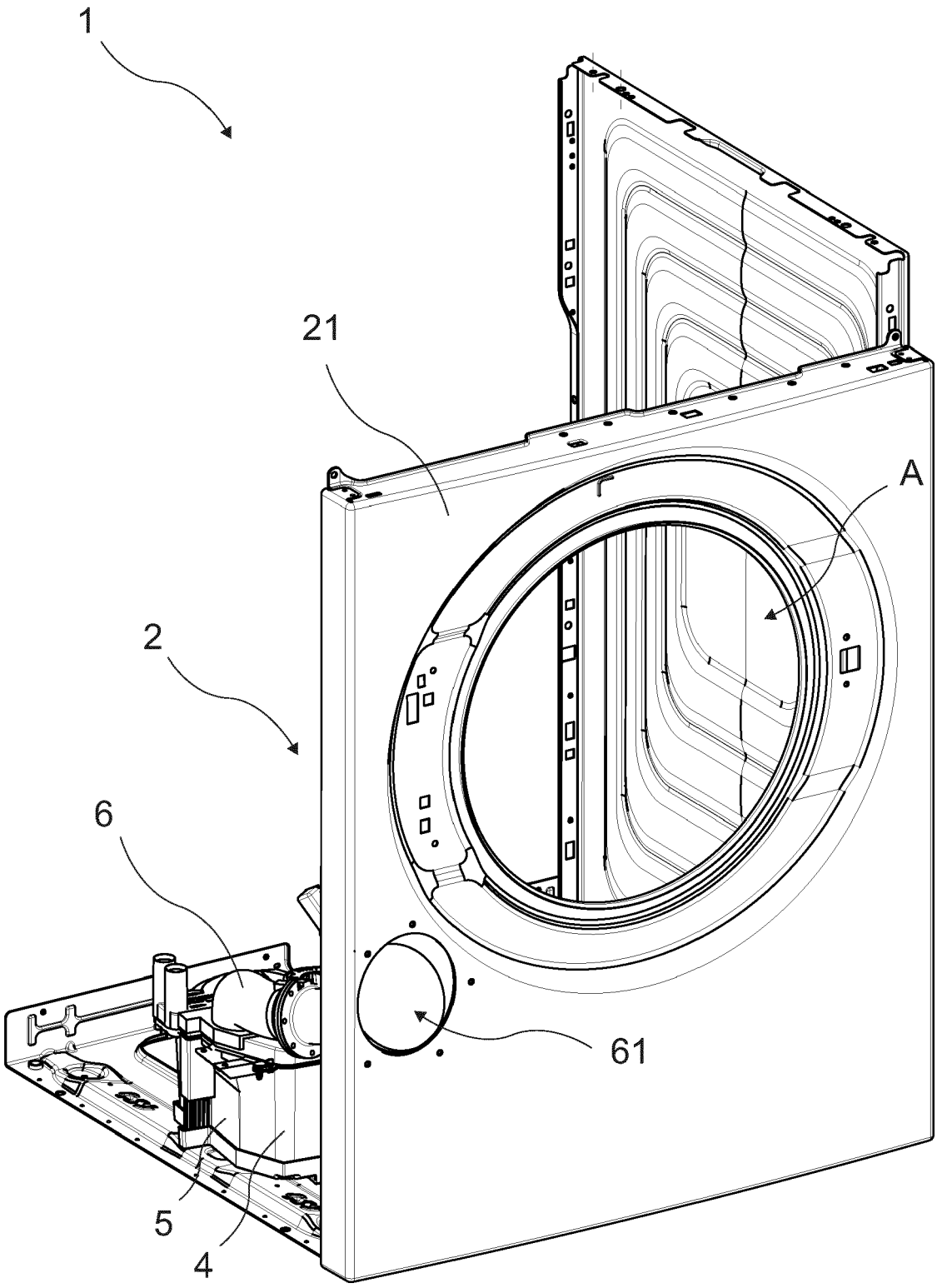


Figure 3

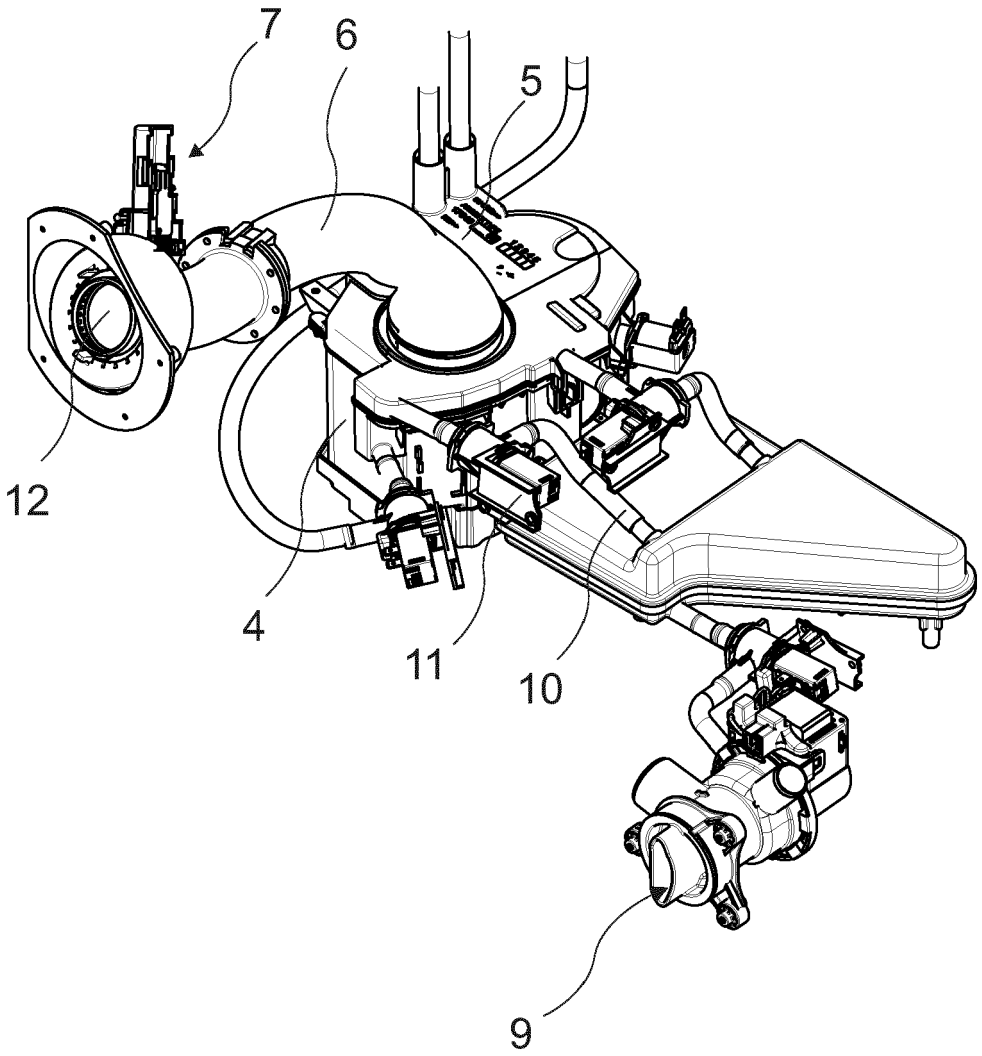


Figure 4

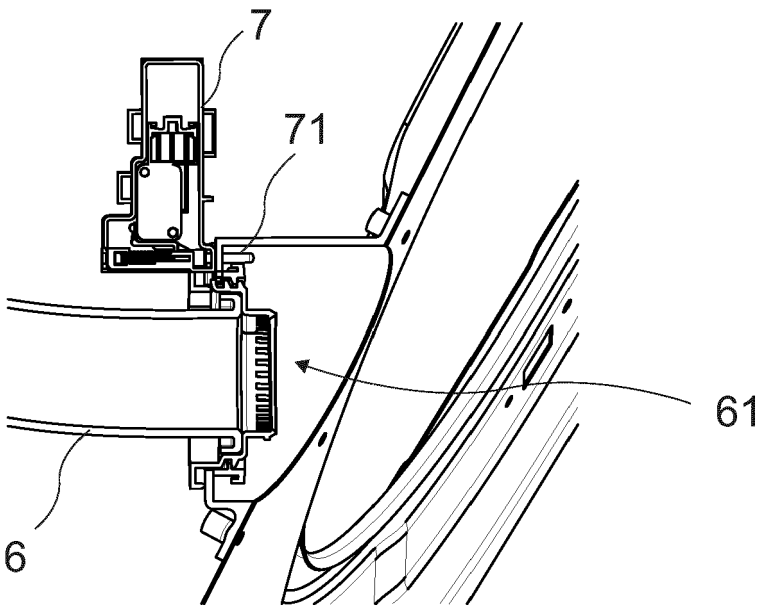


Figure 5

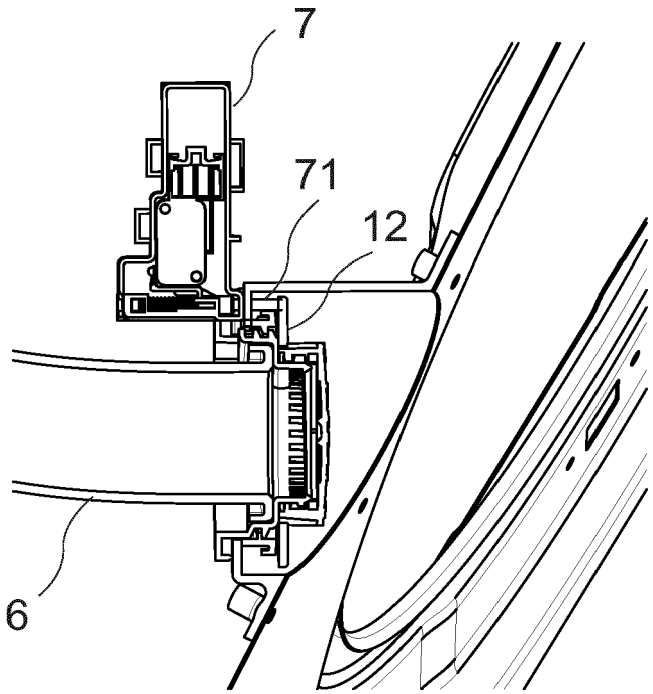
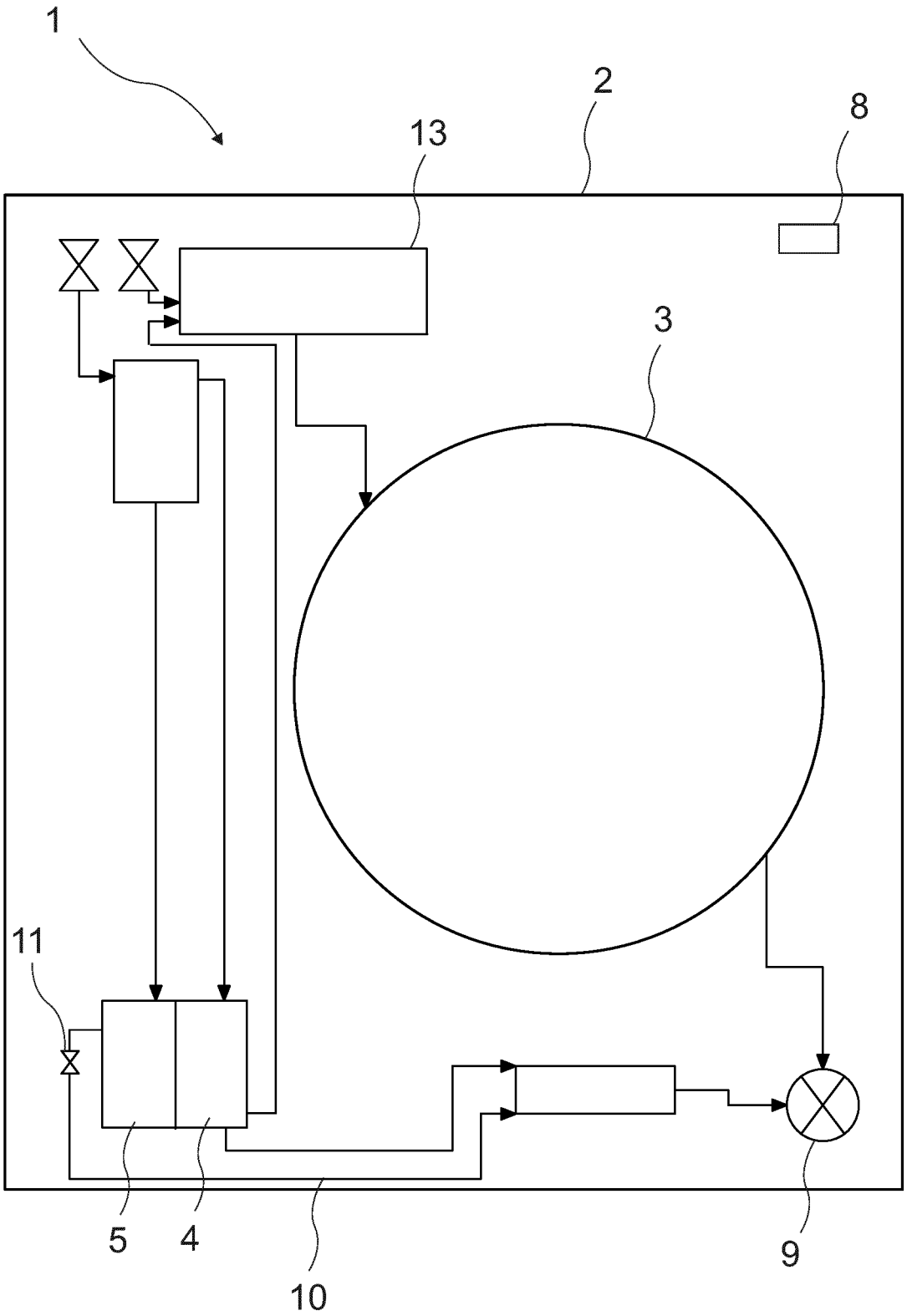


Figure 6



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EUROPEAN SEARCH REPORT

Application Number
EP 23 22 0161

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 107 201 631 B (HISENSE (SHANDONG) REFRIGERATOR CO LTD) 18 February 2020 (2020-02-18)	1	INV. D06F39/00
Y	* paragraph [0036]; claims; figures *	2,3,5,6, 8	ADD. D06F39/12
A		4,7	

Y	EP 0 158 392 B1 (BAUKNECHT HAUSGERAETE [DE]) 26 July 1989 (1989-07-26) * column 3, line 23 - line 31; claims; figures *	2	

Y	EP 2 579 763 B1 (ARCELIK AS [TR]) 30 April 2014 (2014-04-30) * paragraph [0020]; claims; figures *	3	

Y	EP 3 632 286 B1 (VESTEL BEYAZ ESYA SANAYI VE TICARET AS [TR]) 30 June 2021 (2021-06-30) * paragraphs [0024] - [0028]; figures *	5,6,8	

TECHNICAL FIELDS SEARCHED (IPC)

D06F
A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 May 2024	Popara, Velimir

CATEGORY OF CITED DOCUMENTS

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16-05-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 107201631 B	18-02-2020	NONE	
EP 0158392 B1	26-07-1989	DE 3410651 A1	03-10-1985
		EP 0158392 A1	16-10-1985
		ES 8700565 A1	16-10-1986
EP 2579763 B1	30-04-2014	EP 2579763 A1	17-04-2013
		PL 2579763 T3	30-09-2014
		WO 2011154426 A1	15-12-2011
EP 3632286 B1	30-06-2021	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2018103962 A1 **[0003]**